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Description

Standby power supply and an associated method

The present invention relates to a standby power supply and to an associated method and, in particular, to a standby power supply in a telecommunications terminal comprising a base station and at least one cordless mobile part.

Telecommunications terminals in the form of cordless mobile applications are becoming increasingly important since they allow greater flexibility for the user, with reduced installation complexity. Normally, such telecommunications terminals comprise a base station which draws its power supply from an electrical mains system and is connected via a communications link (for example a telephone line) to a communications network. An associated mobile part is preferably cordless, and is connected to the base unit via, for example, a standardized radio interface (for example, DECT).

During normal operation, such a conventional base unit is supplied with power from the electrical mains system, while the mobile part draws its power supply from a mobile power supply, such as a rechargeable energy store. While it is being charged, the mobile part is normally held in the base unit, and is charged via the electrical mains system. However, telecommunications terminals such as these have a disadvantage when it is impossible to supply power from the electrical mains system owing to defects or a power failure. In a case such as this, the base unit cannot set up a link either to the mobile part (or to a large number of mobile parts) or the communications network, so that the communications link is interrupted, or fails.

Thus, in order to maintain a communications link in an emergency as well, the base unit normally has a so-called standby power supply, which ensures that at least the essential functions can be operated.

Figure 1 shows a simplified block diagram of a telecommunications terminal with a standby power supply according to the prior art, as is known, for example, from the document US 5,495,530. The reference symbol 1 in Figure 1 denotes a base unit, which is connected to a mobile part 2 via a radio link. The base unit 1 and the mobile part 2 have a respective antenna AB and AM for this purpose, with an associated transmitting/receiving apparatus (which is not shown). The mobile part 2 has a mobile power supply unit EM for supplying power, and this is normally in the form of a rechargeable energy store. In order to charge this mobile power supply unit EM, the mobile part 2 can be connected to a charging interface 3 with an associated charging circuit (which is not shown).

A power supply unit 6, which is connected to an electrical mains system EN via a power supply line 4 is used to supply power to the base unit 1. The electrical mains system EN provides an AC voltage, normally of 115 V or 230 V. The power supply unit 6 converts this voltage to a DC voltage, which is used as the supply voltage for the base unit 1. In this case, the power supply unit 6 may be integrated in the base unit 1, or may be connected as an external power supply unit. A communications link 5 which comprises, for example, a/b conductors is provided for connecting the base unit 1 to a communications network KN. If the power supply line 4 is interrupted, or the electrical mains system EN fails, a standby power supply for the base unit 1 is, according to Figure 1, derived from the communications link 5 via a standby power supply unit NSV (standby operation).

A standby power supply such as this makes use of the fact that a certain power supply capability is available, as a standby power supply, on the communications link 5 from the communications network KN. In this way, during standby operation, the base unit 1 can be supplied with power, as shown in Figure 1, such that a communications link can be set up from the mobile part 2 to the communications network KN, or from the mobile part 2 to another mobile part, which is not shown. However, this has the disadvantages that the circuit complexity in the base unit 1 is high and that it is dependent on a physical connecting line 5, from which the standby power supply is derived.

Figure 2 shows a simplified block diagram of a further telecommunications terminal with a standby power supply according to the prior art. The same reference symbols denote the same or similar components, which will therefore not be described in detail in the following text.

In contrast to Figure 1, the conventional telecommunications terminal shown in Figure 2 has a rechargeable energy store or a battery as the standby power supply unit, and this provides the necessary standby power supply for the base unit 1 during standby operation. The circuitry complexity in the base unit 1 is thus greatly reduced, and, furthermore, there is no dependency on any physical communications interface (as in Figure 1). This is particularly important when the communications link 5 is in the form of a radio link or link via optical waveguides to the communications network KN, when it is not possible to transmit sufficient power from the communications network KN. However, the standby power supply shown in Figure 2 has the disadvantage that it uses an additional rechargeable energy store or battery block,

since this increases the costs of the base unit 1, and enlarges its dimensions.

EP 0935377 A2, WO 99/31860 and GB 2279827 each disclose a standby power supply, in particular for telecommunications terminals, which comprises a base unit for producing a link to a communications network, a power supply unit for supplying power to the base unit during mains operation, at least one mobile part with an associated mobile power supply unit for producing a link to the base unit, and a standby power supply unit for supplying standby power to the base unit during standby operation, with the standby power supply being taken from the mobile power supply unit for the at least one mobile part by means of the standby power supply unit.

The invention is based on the object of providing a standby power supply and an associated method in particular for a telecommunications terminal, which standby power supply can be produced at low cost and occupies little space.

According to the invention, this object is achieved with regard to the standby power supply by the features of patent claim 1, and with regard to the method by the measures in patent claim 7.

In particular, the use of a standby power supply unit which derives the standby power supply from a mobile power supply for a mobile part considerably reduces the costs and the dimensions of the base unit. Furthermore, such a standby power supply can also be used for telecommunications terminals in which it is impossible to supply standby power via a communications network. One part of the power supply unit represents a DC isolation unit for the standby power supply unit, thus making it possible to satisfy the stringent licensing

requirements for exposed contacts (charging contacts) for a telecommunications terminal in a simple and low-cost manner. The standby power supply unit is in this case generally located in the mobile part, having an

operating mode detection unit which detects each operating mode. This allows the mobile part to reliably identify whether it is in a normal mode, a charging mode or a standby mode.

The standby power supply unit preferably has a DC/AC inverter in order to convert a DC voltage from the mobile power supply unit to an AC voltage for supplying standby power to the base unit. This allows the standby power supply to be passed through the DC-isolation unit. A control unit can in this case control the DC/AC inverter as a function of the detected operating mode, such that an optimum operating mode is ensured at all times.

The power supply unit preferably has a switching unit which allows it to be isolated from the electrical mains system during standby operation. This makes it possible to reliably prevent interference produced by the DC/AC inverter from being passed to the electrical mains system. Furthermore, this prevents power from flowing into other loads which may still be connected to the power supply line.

The mobile part is preferably a cordless telephone with a hands-free device, which is placed in a charging shell on the base unit during standby operation. In this case, the base unit with the mobile part placed on it acts like a conventional telephone with a hands-free device, but with the base unit being supplied with power from the mobile part and with cordless communication from the mobile part to the base unit, and then from there to the communications network.

Further advantageous refinements of the invention are

characterized in the other patent claims.

The invention will be described in more detail in the following text using an exemplary embodiment and with reference to the drawing, in which:

Figure 1 shows a simplified block diagram of a standby power supply for a telecommunications terminal according to the prior art;

Figure 2 shows a simplified block diagram of a further standby power supply for a telecommunications terminal according to the prior art;

Figure 3 shows a simplified block diagram of a standby power supply for a telecommunications terminal according to the present invention; and

Figure 4 shows a block diagram of the major components of a power supply unit as shown in Figure 3.

Figure 3 shows a simplified block diagram of a standby power supply for a telecommunications terminal according to the present invention, with the same reference symbols denoting the same or similar components as those in Figures 1 and 2, for which reason they will not be described in detail in the following text.

According to Figure 3, a telecommunications terminal comprises a base unit 1 and at least one mobile part 2. As in the prior art shown in Figures 1 and 2, the base unit 1 is in this case connected via a power supply line 4 and a power supply unit 6 to an electrical mains system EN, with a communications link 5 being used to communicate with a communications network KN.

In Figure 3, the mobile part 2 is a cordless telephone, which is supplied from a mobile power supply unit EM. The mobile power supply unit EM normally has a rechargeable energy store, which can be charged via a charging interface 3 from a charging circuit, which is not shown, in the base unit 1. The charging interface 3 is normally in the form of a charging shell that is integral with the base unit 1.

In a normal operating mode, the standby power supply according to the invention operates essentially in a

similar way to the

prior art as shown in Figures 1 and 2, and this will therefore not be described.

However, in a charging operating mode and, in particular, in a standby operating mode, the telecommunications terminal according to the invention is significantly different to conventional terminals.

To be more precise, a standby power supply unit NSV, which is preferably located in the mobile part 2, supplies the base unit 1 when conventional mains operation (during which power is supplied via the electrical mains system EN) is impossible. As shown in Figure 3, the standby power supply for the base unit 1 is in this case derived by the standby power supply unit NSV from the mobile power supply unit EM (a rechargeable energy store), and is supplied to the base unit 1 via the charging interface 3.

In contrast to the conventional standby power supply shown in Figure 1, there is thus no need for any complex circuitry within the base unit in order to convert power provided from the communications network KN via the communications link 5 to a standby power supply. Furthermore, the standby power supply according to the invention can also provide standby power operation when the communications link 5 is a radio link (for example a satellite link) or a link via glass fiber cable, in which case it is normally impossible to supply power from the communications network KN.

Furthermore, the present invention has the advantage over the conventional standby power supply shown in Figure 2 that no further rechargeable energy store or battery block need be used for the standby power supply unit in the base unit 1, thus making it possible to reduce not only the costs but also the dimensions of the base unit. Thus, according to the invention, the

mobile power supply unit EM, which is present in any case in the

mobile part 2, is used as a standby power supply for the base unit 1. The standby power supply unit is preferably not physically located in the base unit 1, so that an already existing system can be provided with the standby power capability according to the invention simply by purchasing mobile parts 2 or power supply units 6 with a standby power supply capability.

Figure 4 shows a detailed block diagram of one preferred exemplary embodiment of the major parts of a telecommunications terminal with a standby power supply. In Figure 4, the reference symbol 6 denotes the power supply unit for the base unit 1, which is preferably located in an external power supply device, and thus can easily be replaced. The power supply unit 6 is connected via the power supply line 4 to the electrical mains system EN, which normally provides an AC voltage of 115 V or 230 V. The power supply unit 6 contains a primary coil L3 as well as a first and a second secondary coil L1 and L2, via which an AC voltage U_B is produced for the base unit 1, and an AC voltage U_{MT} is produced as a charging voltage for the at least one mobile part 2.

The first secondary voltage U_B produced by the power supply unit 6 is supplied to a rectifier circuit 8 in the base unit 1, thus producing a DC voltage VVC_B with respect to ground GND_B. The rectifier circuit 8 is preferably a diode circuit with 4 diodes D3, D4, D5 and D6, and a capacitor C1 for smoothing the ripple on the rectified voltage.

In contrast, the mobile part 2 has a standby power supply unit NSV, which operates in 3 different operating modes.

These are, firstly, the normal mode in which the mobile part is isolated from the charging interface 3 and the

base unit is supplied with power from the power supply unit 6. In this case,

the mobile part 2 is operated via the built-in mobile power supply unit EM, with a voltage which is dependent on the nature and number of rechargeable energy source cells that are used being produced at a connection VCC_{MT}. A connection GND_{MT} is in this case a reference point. The voltage supply VCC_{MT} and GND_{MT} obtained in this way is normally then raised by a converter circuit, which is not shown, to a higher stabilized voltage, thus producing the actual voltage or power supply for the mobile part. A measurement point MP of the standby power supply unit NSV in this case has a high impedance in the normal operating mode, since there is no link to the power supply unit 6 via the charging interface 3.

In a charging operating mode, the mobile part 2 is preferably located in the charging shell (not shown) of the base unit 1, that is to say the mobile part 2 is connected to the charging interface 3. As shown in Figure 4, the charging interface 3 is connected to the second secondary coil L2 of the power supply unit 6, and thus receives an AC voltage when the mains supply is available. In consequence, in the charging operating mode, the mobile power supply unit EM is charged via a rectifier circuit and a current limiting circuit.

In the simplest case, this rectifier circuit comprises a diode D1 (half-wave rectifier) and the current limiting circuit comprises a series-connected resistor R1. The rectifier circuit D1 and the current limiting circuit R1 are connected, as shown in Figure 4, in a common current path in the mobile power supply unit EM. A positive half-cycle, which can be detected by a detection unit EE, is thus produced at the measurement point MP in the charging operating mode. A control unit SE evaluates the voltage signals detected by the detection unit EE, and drives a switching unit Q1 such that the switching unit Q1 always remains open in the

charging operating mode. This allows the mobile power supply unit EM to be charged via the power supply unit 6.

In a standby operating mode, in which a mains system failure or some other defect means that no power is being supplied from the electrical mains system EN, the first voltage U_B and the second voltage U_{MT} from the first and second secondary windings L1 and L2 are initially 0 V. In consequence, no communications link can be provided via the base unit 1. Thus, in order to provide a standby power supply, a link is produced between the base unit 1 and the mobile part 2 via the charging interface 3 (for example by part placing the mobile part 2 in the charging shell), with a voltage of the same magnitude as the rechargeable energy store voltage being produced at the measurement point MP (the mobile power supply unit EM is short-circuited to the measurement MP via the second secondary coil L2 in the power supply unit 6). This change in voltage at the measurement point MP is detected by the detection unit EE and is passed on to the control unit SE. As shown in Figure 4, the detection unit EE comprises a diode D2 and a capacitor C2 connected to ground. Furthermore, a resistor R2 can optionally be connected in parallel with the capacitor C2.

The detection circuit EE thus detects the voltage change (application of the rechargeable energy source voltage) at the measurement point MP, and signals this to the control unit SE. The control unit SE comprises, for example, a microprocessor or a microcontroller, but may also be in the form of an analog or discrete control block.

In consequence, as shown in Figure 4, the voltage VCC_{MT} from the mobile power supply unit EM is supplied during standby power operation to the switching unit Q1, which can be driven by the control unit SE. The switching unit Q1 in this case operates in conjunction with the second secondary winding L2 in the power supply unit as a flyback converter, with the switching frequency of

the flyback converter being governed by the control unit SE. In consequence, the switching unit Q1 is swiched on and off in an appropriate manner such that the voltage VCC_{MT} (+2.4V) produced at the measurement point MP is briefly grounded, so that corresponding induction currents and voltages are induced,

via the second secondary coil L2, in the primary coil L3 and in the first secondary coil L1. In consequence, if the switching unit Q1 is driven in a suitable manner by the control unit SE, a voltage U_B' can be produced in the first secondary coil L1, corresponding to the normal induced voltage U_B and this is thus rectified via the rectifier circuit 8 in the base unit 1 as the supply voltage. In consequence, there is no need for any changes whatsoever to be carried out in the base unit 1 in order to produce a standby power supply, since the entire circuit for the standby power supply is located in the mobile part 2. Furthermore, the standby power supply shown in Figure 4 complies with all the requirements relating to the telecommunications licensing and safety standards, since high-quality DC isolation is used for the power supply unit 6.

The power supply unit 6 may preferably be in the form of an external power supply device, with an additional modification improving the effectiveness of standby operation. As shown in Figure 4, the power supply unit 6 in this case has a mains switching unit RE on the primary side, which allows disconnection or isolation from the electrical mains system EN during standby operation. This mains switching unit RE preferably comprises a latching AC relay, which is switched on only when a supply voltage is present. When a mains failure or a defect occurs, the mains switching unit RE opens the contacts for the primary coil L3, so that this is completely decoupled from the electrical mains system EN and from any further load units, which are not shown. This ensures that the flyback converter frequency which is produced in the standby power supply unit NSV is not passed in the form of interference via the power supply unit 6 into the electrical mains system EN. In addition, it prevents any power from flowing to other load units (not shown) which may still be connected to the power supply line 4.

The invention has been described above with reference to a base unit with a cordless telephone. However, it is not restricted to this and, in fact, covers all other mobile applications in which a mobile part is connected together with a mobile power supply unit to an associated base unit. Accordingly, so-called laptops, notebooks, palmtop units or other mobile applications operated from rechargeable energy sources and which are connected to a base unit via an interface that transmits power can also be used as mobile parts.

Furthermore, a large number of mobile parts may be connected to one base unit with, for example, one mobile part being used as a standby power supply unit, and hence allowing communication with the other mobile parts via the base unit.

The mobile part is preferably a cordless telephone with a hands-free device, thus simplifying standby operation to an extraordinary extent. The communications network KN described above is preferably in the form of a bidirectional network, comprising public switching systems. However, it is not restricted to this and, in fact, includes all other communications networks (satellite systems, private switching systems, ...) via which telecommunication is possible.